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PHASE 1 REPORT FOR CONTAMINATION ASSESSMENT INVESTIGATION CHICORA
TANK FARM (CTF) CNC CHARLESTON SC
12/01/1988
NAVFAC SOUTHERN

PHASE I REPORT
CONTAMINATION ASSESSMENT INVESTIGATION

CHICORA TANK FARM

**Charleston Naval Shipyard
Charleston, South Carolina**

December 1988

PREPARED BY:

**SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND**

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REVIEWED BY:

James B. Malone, P.E.

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50K

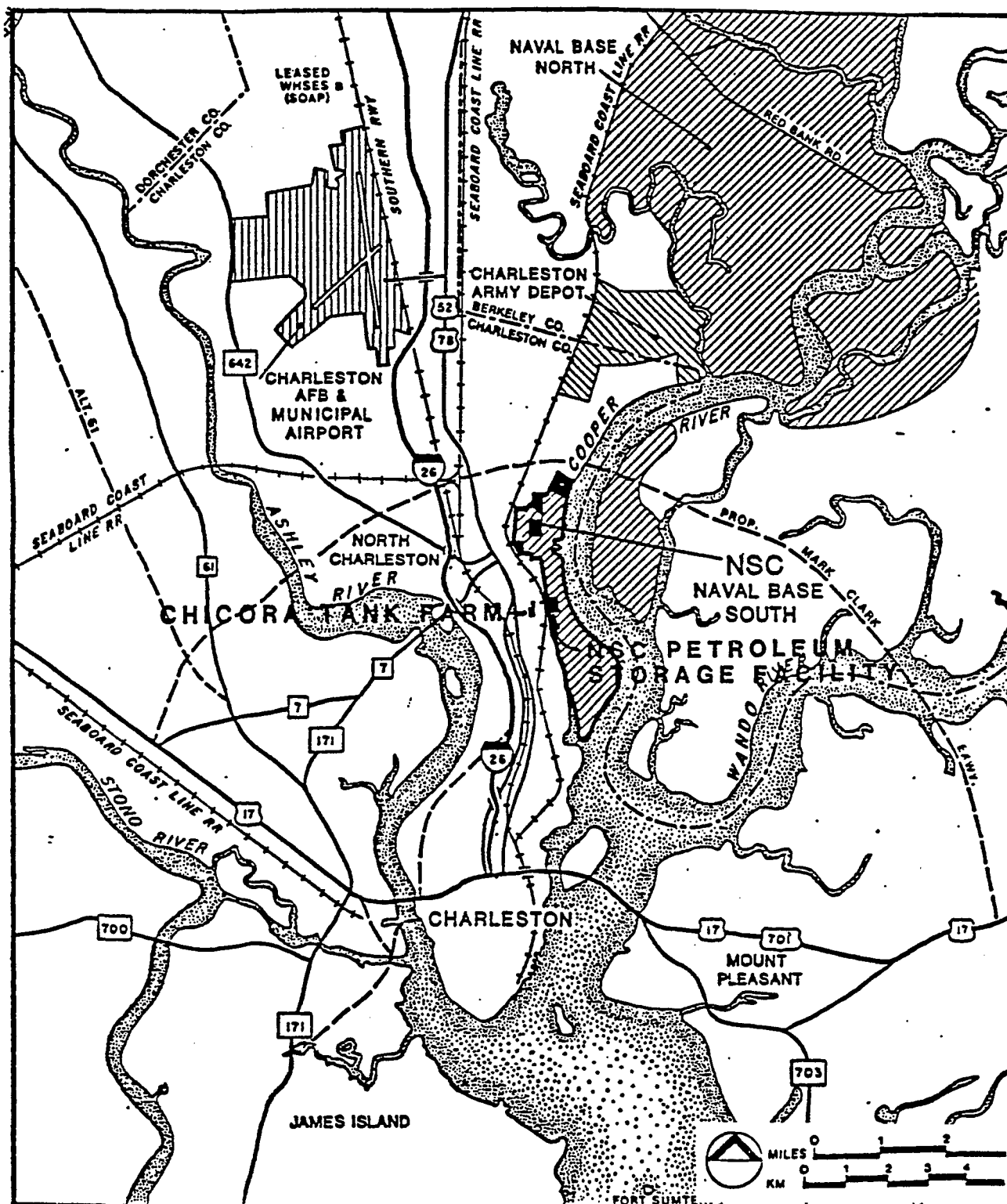
EXECUTIVE SUMMARY

Onsite evidence indicates that the tanks at Chicora Tank Farm are leaking or have leaked product into the surrounding environment. The tank farm's storm sewer system is contaminated with fuel and is discharging free product into the adjacent creek. The fourteen year old spill containment facility is not functioning properly and will require substantial renovation and repair to meet current environmental regulations.

Further investigation is needed to determine the source and extent of contamination. SOUTHNAVFACENGCOM will conduct a Phase II Contamination Investigation using Defense Environmental Restoration Account Funds in third quarter FY 89, pending availability of funds.

In the interim, all tanks and piping at the fuel farm should be tested for leaks and measures should be taken to prevent further release of product to the environment.

The decision concerning repair or replacement of Chicora Tank Farm should be postponed until the Phase II investigation is concluded. The quantity and location of any soil/groundwater contamination discovered may impact the chosen alternative.



NAVAL FACILITIES
ENGINEERING COMMAND
SOUTHERN DIVISION

V I C I N I T Y M A P
11

CHICORA
TANK FARM

CHICORA TANK FARM
NSC CHARLESTON, SC
PHASE I CONTAMINATION INVESTIGATION REPORT

1.0 INTRODUCTION

Commander, Charleston Naval Shipyard (Code 420), Charleston, South Carolina, per Engineering Service Request (SOUTHNAVFACEGCOM # 8256-240) of 12 September 1988, requested assistance in determining the origin of fuel oil discovered in the tank farm's drainage system and the degree of soil and/or groundwater contamination that may have occurred at the site.

1.1 OBJECTIVE

The primary objective of the Phase I Preliminary Contamination Assessment Investigation is to determine the probability of site contamination and make recommendations for any interim remedial measures needed to control the release or migration of contaminants.

The Phase II Assessment, if needed, will be a more in-depth study to quantify the source, location, and amount of any contamination discovered or suspected during the Phase I investigation.

1.2 BACKGROUND

The Chicora Tank Farm is owned and operated by the Naval Supply Center (NSC), Charleston, SC and is located approximately 200 yards West of the Charleston Naval Base and has been in continuous use since 1943.

1.2.1 TANK STORAGE

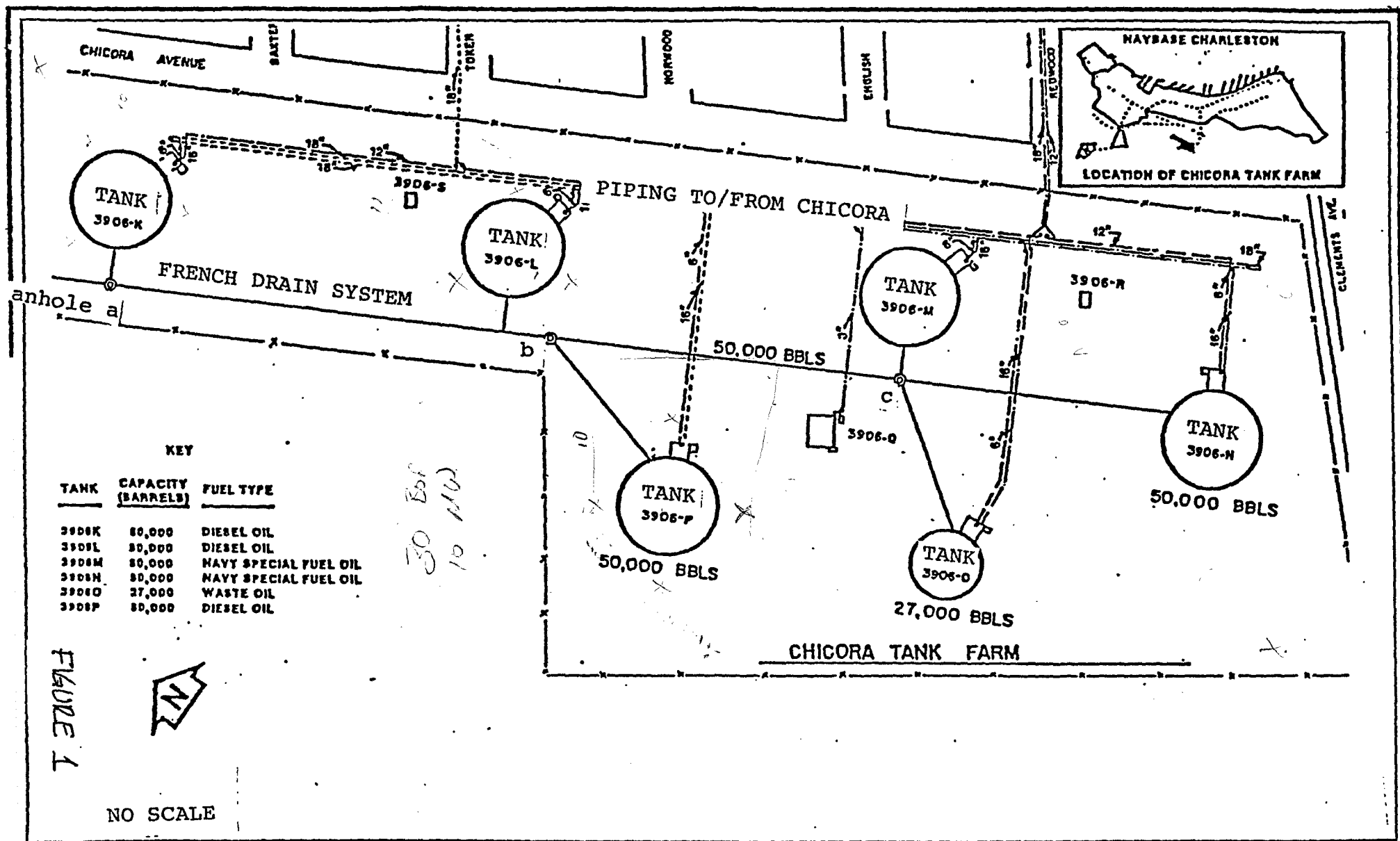
The tank farm stored No. 6 fuel oil until sometime around 1960. The highly viscous No. 6 fuel was heated by steam supplied by an onsite boiler and underground steam lines. From 1960 to present, various products have been stored in the tanks, including Diesel Fuel Marine (DFM), Navy Special Fuel (NSFO) No. 5, Marine Diesel, and waste water and waste oil.

Currently tanks 3906-K, L, and P are used to store DFM and tanks 3906-M and N store NSFO. Tank 3906-O is used to store waste water and oil. The tank farm layout is shown in Figure 1.

1.2.2 TANK CONSTRUCTION

The concrete tanks are column supported with 24" reinforced concrete walls and have a reinforced concrete domed roof. The pumphooms are attached to the sides of the tanks.

The tanks vary in size. Five of the tanks have a capacity of 50,000 barrels each and the sixth, about 27,000 barrels. The tanks and pumphooms are above normal grade and covered with soil.



CHICORA TANK FARM LAYOUT

FIGURE 1

The tanks' exteriors are coated with 3" of gunite to reduce surface water intrusion. The pumprooms' interiors are coated with 3/4" of plaster over a waterproof membrane. The interior of the tanks are not lined because the tanks were originally designed to store No. 6 fuel oil.

The pumprooms are approximately 23'X24'X27' and contain one 150 HP transfer pump, one 10 HP stripper pump, and various abandoned steam piping. The pumproom must be entered through a hatchway on the roof. Figure 2 provides a schematic of the pumproom piping layout.

1.2.3 PIPING

The tank sumps are located adjacent to the pumprooms and contain a supply pipe, a return pipe, and a waste water drain pipe. Discharge from the tank sumps and pumproom sumps is piped to the Base wastewater treatment plant.

The 18" supply and return lines are run underground to the shipyard at Token and Redwood Street. According to old drawings, the pipes are coated with bitumastic enamel and tarred asbestos felt.

Potable water is supplied to the tank farm by the City of Charleston Public Works Department.

Site drainage includes 12" underground storm drains from each tank discharging to a single 18" collection main which empties into a surface water retention lagoon. The main originally discharged directly into the adjacent creek prior to the construction of the lagoon. The 12" lines are believed to be connected to "french drains" beneath the tanks and were apparently installed to prevent tank damage due to fluctuations of the water table.

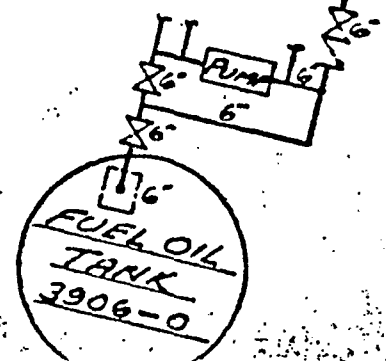
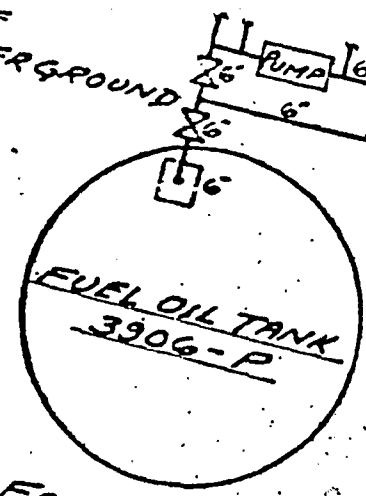
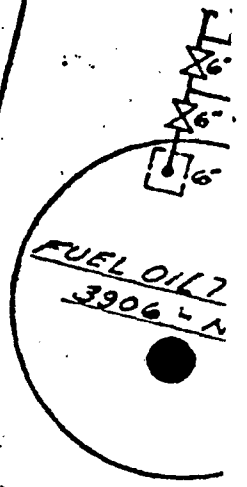
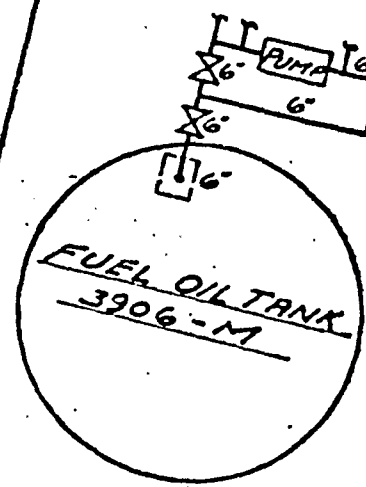
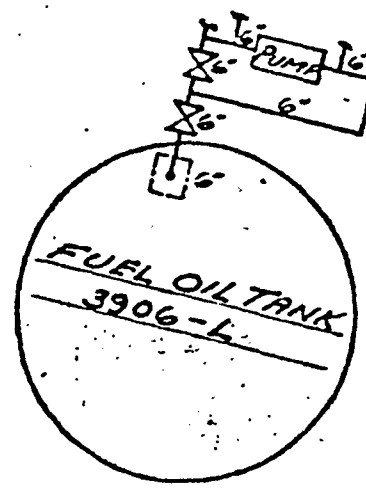
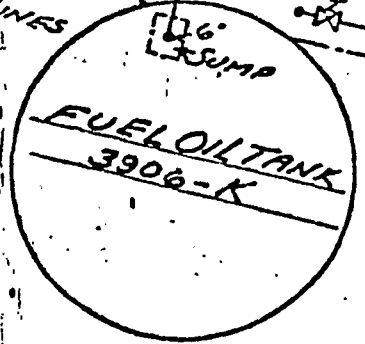
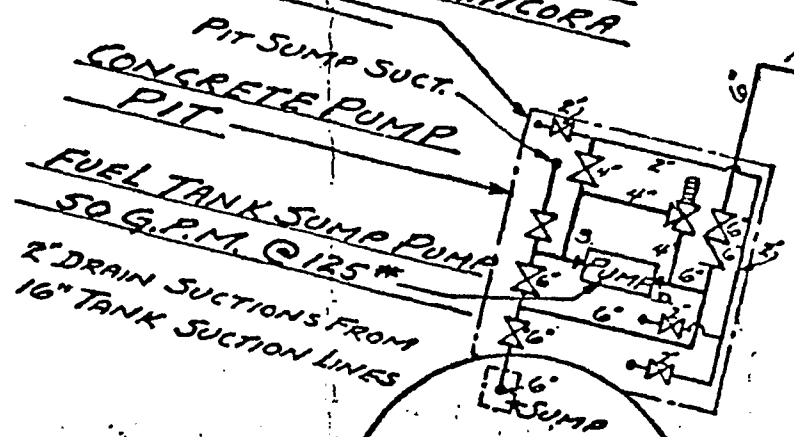
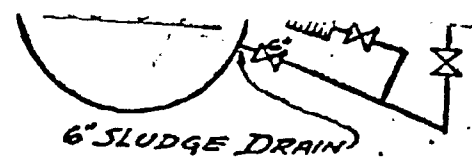
1.2.4 CONTAINMENT SYSTEM

A spill containment system was installed in 1974 at the tank farm consisting of a lined ditch on the Northeast boundary of the farm and a lagoon and skimmer system on the Southwest boundary. The ditch was designed to catch surface runoff from the tank farm and direct it through the lagoon and skimmer prior to discharge to the adjacent creek. Discharge from the french drain system was also routed through the lagoon to eliminate the direct discharge to the adjacent creek. Figure 3 provides a schematic of the containment system.

1.2.5 PREVIOUS INVESTIGATION

In 1986, SOUTHNAVFACENGCOM conducted a contamination investigation at Chicora Tank Farm via A&E contract to Environmental Science and Engineering (ESE), Inc. The contractor took soil samples from 10-15 foot borings located approximately 40 feet from the tanks. Analysis of the samples taken from the soil borings were negative for fuel indicator chemicals Benzene, Toluene, and Xylene. Tests for Total Recoverable Petroleum Hydrocarbons were also below detection limits.

16" PUMP PIT PUMP & PIPING
SIMILAR FOR ALL SIX CHICORA
TANKS



NOTE:-
ALL CHICORA TANKS ARE
CONCRETE & ARE UNDERGROUND

CHICORA TANK FARM

FIGURE 2
PUMP ROOM SCHEMATIC



CHICORA PARKWAY

30 MIL LINED DITCH

NEW 16' GATE

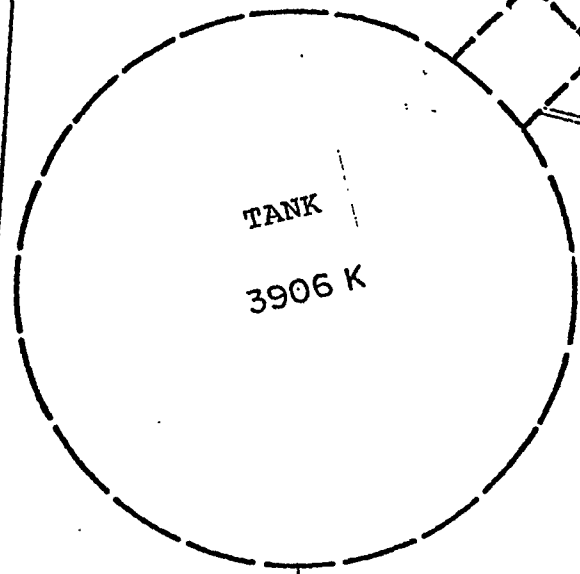
ADJACENT CREEK

30 MIL LINED POND

BERM

PIPE TO CREEK

DIKE/SKIMMER SYSTEM



TANK
3906 K

12"

MANHOLE A

18" FRENCH DRAIN PIPE

FIGURE 3
CONTAINMENT SYSTEM

NORMAN C. TOOLE MIDDLE SCHOOL

The Contractor concluded that it did not appear that the Chicora tanks were leaking product into the surrounding soil, based on the results of the soil samples. The location of the soil samples relative to the tanks is depicted in Figure 4.

1.2.6 RELEASE DISCOVERY

After IMPROVED DETECTION FOR DEKA TEST.

On 11 August 1988, NSC personnel discovered free product in one of the manholes of the french drain system at Chicora Tank Farm. Lab analysis of the product confirmed the presence of a combination of DFM and NSFO. SOUTHNAVFACENGCOM was subsequently requested to conduct an investigation to determine the source of the free product.

1.3 DISCUSSION

1.3.1 INVESTIGATION

After receiving an Engineering Service Request from NSC Charleston, SOUTHNAVFACENGCOM began a Phase I Preliminary Contamination Assessment to confirm the probability of tank or pipe leakage and to determine the need for a more indepth Phase II investigation.

The Phase I investigation was limited to site inspection, review of existing documents and drawings, and personnel interviews and discussions with the following personnel:

NSC Charleston Personnel:

Lt. L.C. Sullivan, NSC Fuel Dept. Director
Mr. Saul Washington, NSC Fuel Dept. Deputy Director
Mr. Archie Muckenfuss, NSC Facilities/P-24 Project

SOUTHNAVFACENGCOM Personnel:

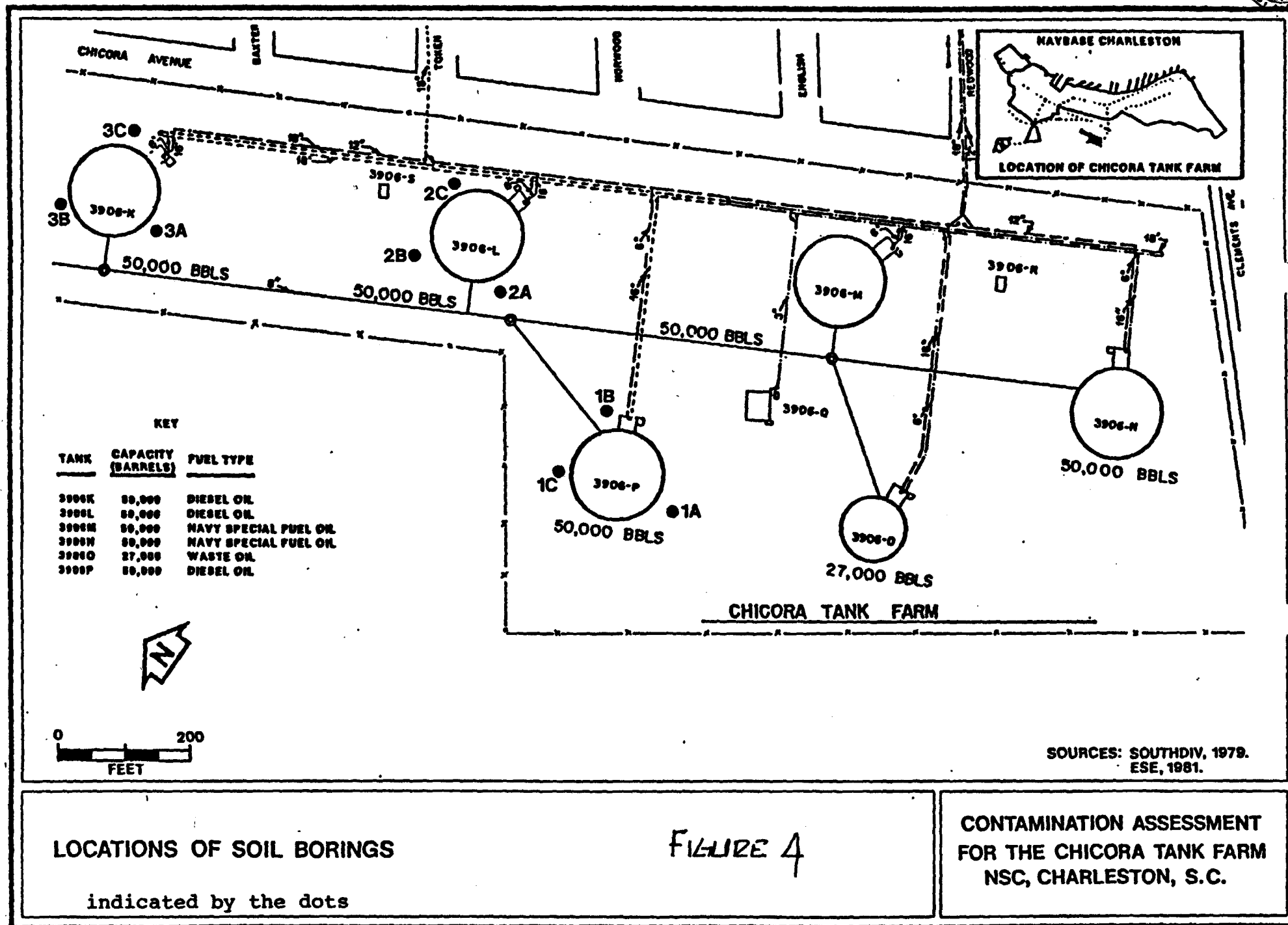
Mr. David Warren, Code 04031, Mechanical tank design
Mr. Mark Dillon, Code 04022, Structural Concrete Design
Mr. James Malone, Code 1143, Fuel migration
Mr. Daryle Fontenot, Code 11444, UST program
Mr. John Albrecht, Code 11443, UST program
Mr. Don Gerhardt, Code 04A2, Tank liners
Mr. Reece Batten, Code 11441, P-224 environmental problems
Mr. Wayne Cotton, Code 04032, Mechanical design/P244 EIC

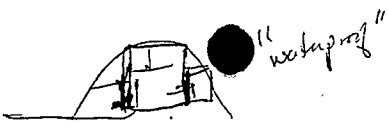
Other Personnel:

Mr. Norm Schmokel, Navy Petroleum Office
Mr Jeff Haas, Austin Brockenbrough, similar tank farm work

1.3.2 LEACHING

The unlined tanks at Chicora were originally designed to contain the very viscous No. 6 fuel oil. Unlined concrete is normally to porous to contain the low viscosity fuels currently stored in the tanks.




Evidence of leaching through the tank walls can be seen inside the pumphouses. Enclosure (5) photographs depict the easily discernible leach line of tank 3906-K.

Leaching of product through the pumphouse tank walls is at a very slow rate and is not detectable by normal inventory control methods which cannot detect less than a 521 gallon per day loss rate. According to NSC's Mr. Saul Washington, product has been leaching into the pumphouses since he began work at Chicora 20 years ago. Leach rate through the tank walls at other locations is unknown since the walls are not visible due to the soil cover.

Leached product will migrate downward and be collected by the french drain system, be adsorbed by the soil, or settle on the water table depending on the volume and rate of leaching. Since the tanks have been leaching for quite a number of years, there is a possibility that the groundwater may have been contaminated. The lack of hydrocarbons in the soil samples analyzed in the 1986 investigation does not provide conclusive evidence either way. A more comprehensive investigation which includes the installation of groundwater monitoring wells will be required to confirm the extent of environmental contamination.

1.3.3 TANKS

There is no evidence that the products stored at Chicora, both past and current, have caused structural damage to the tank walls. The acids in waste oils currently stored in tank 3906-O could possibly attack the reinforcing steel resulting in structural failure. Freeze-thaw damage is not a concern since the tanks are protected from freezing by soil cover.

The previous investigation conducted in 1986 recommended that the walls be analyzed for deterioration by a concrete specialist. To date, NSC personnel have not complied with the A&E's recommendation.

1.3.4 - PIPING

To date, 10 Chicora piping leaks have been documented:

- 03/81 18" NSFO line at Redwood Street
- 07/81 12" Sludge line, Chicora
- 04/83 12" Sludge line, Chicora
- 12/83 18" NSFO line at Hobson & Viaduct Road
- 03/84 Bypass line at Tank 3906-N
- 02/85 Supply line at Tank 3906-O
- 02/85 Bypass line at Tank 3806-N
- 07/85 Stripper line at Tank 3906-O
- 09/85 Sludge line at Tank 3906-M
- 10/87 Sludge line at Tank 3906-O
- 09/88 Waste water line, Pumphouse of Tank 3906-O

During the site visit of 28 September 1988, a pipe break was observed in the pumphouse of tank 3906-O. The 18" waste water supply line had broken and spilled approximately 50,000 gallons into the pumphouse. NSC workers were pumping the waste water into the french drain system which

discharges to the retention lagoon and subsequently into the adjacent creek.

1.3.5 CONTAINMENT SYSTEM

The spill containment system installed at Chicora in 1974 has not been maintained for 5-6 years. The skimmer system is inoperable and any spilled or leached product reaching the lagoon via the french drain system or otherwise is discharged directly to the adjacent creek and subsequently to the Cooper River.

The 30 mil thick material lining the containment ditch and the liner on one of the lagoons is completely deteriorated. The liner on the other lagoon is bubbled-up due to the formation of peat gas under the liner.

A slight sheen was visible on the surface of the lagoon during the site visit. Lagoon influent from the french drain system had a yellowish brown appearance and the vegetation surrounding the lagoon appeared to be distressed. Since the lagoon skimmer and dike system is inoperable, any product reaching the lagoon will be discharged directly into the adjacent stream. In August 1988, during heavy rains on a high tide, the lagoons overflowed their embankments and the road, emptying their contents into the adjacent creek.

1.3.6 PREVIOUS INVESTIGATION

The soil borings by ESE Inc. in 1987 were taken 40 feet from the tanks to allow drilling off the tank slopes and to avoid drilling into underground utilities. There may be several possible explanations as to why no product was found in the soil borings.

Any tank leaching or leaks would normally migrate downward due to gravity. The fuel may have adsorbed to the soil until a saturation point was reached at a later date. Contaminant migration, though normally vertically, may have been influenced by horizontal pathways created by utility trenches with high porosity backfill. Another possibility is that the free product has not had time to migrate far enough to be detected in the soil borings. The groundwater flow rate in the Chicora area is unknown and could vary considerably due to the buildup and utility construction in the area. The french drain system may have also intercepted the product and routed it through the lagoons in such small quantities that it went unnoticed.

1.3.7 SITE OBSERVATIONS

Free product was observed floating in each of the three manholes providing access to the french drain system's main collection line during site visits on 19 and 28 September 1988.

Up to two inches of a dark oily product was observed floating in manhole A (nearest the lagoon) and manhole B (near tank 3906-P). Manhole C (between tanks 3906-O and 3906-M) had a light oily sheen on the water surface. The concrete in manholes A and B was coated with a dark oily sludge below the water surface.

The possible sources of the product include previous spills, illegal dumping into the drainage system, tank leaks, leaking piping, or migration from offsite sources.

1.3.8 EXPOSURE PATHWAYS

The primary offsite human exposure pathways are contact with contaminated surface water and groundwater.

Migration of fuel oils in groundwater could potentially contaminate offsite shallow water wells resulting in subsequent human ingestion of contaminants.

Discharge of contaminants into the Chicora lagoons subsequently enters the adjacent creek and flows into the Cooper River and eventually into Charleston Harbor. Recreational fishing and other water sports is popular in the nearby creeks and beaches, providing a potential for exposure by absorption and inhalation. Serious exposure through ingestion is possible should the local food chain become contaminated.

Onsite vapors may migrate into adjacent structures resulting in inhalation exposure. The volatile constituents of the fuel vaporizing on the surface of the water can also provide an inhalation hazard. Onsite sewer manholes, pumprooms, or ductbanks are typical examples of potential inhalation exposure areas.

1.3.9 APPLICABLE REGULATIONS

STATE REGULATION

South Carolina's 1976 Pollution Control Act, Section 48-1-90 makes it unlawful to throw, drain, run, allow to seep or otherwise discharge organic or inorganic matter into the environment of the State except in compliance with a permit issued by the Department of Health and Environmental Control (DHEC).

SC Underground Storage Tank Regulation, R.61-92.8D (5), requires the reporting to DHEC within 72 hours any loss or gain of product that can not be reconciled by inventory investigation.

EPA'S UNDERGROUND STORAGE TANK REGULATIONS

EPA's Underground Storage Tank Regulations, 40 CFR 280, specifically exempt bulk fuel tanks from the requirements of Subparts B, C, D, E, and G. Corrective actions required under Subpart F were not deferred, however, and do apply to the tanks at Chicora.

Subpart F addresses specific reporting and corrective action requirements. Since free product has been observed discharging from the french drain system, a confirmed release, as defined in 40 CFR 280.12, has occurred and NSC must comply with the requirements of 40 CFR 280, Subpart F.

The basic initial response requirements of Subpart F which apply to Chicora are:

- Report release to EPA
- Take immediate action to prevent further release
- Identify and mitigate fire, explosion, and vapor hazards

The major initial abatement measures which are required unless directed otherwise by EPA are:

- Remove as much product from the tanks as possible to prevent further leaks
- Prevent further migration of any above ground or exposed underground releases
- Continue to monitor and mitigate any additional fire and safety hazards posed by migration of vapors or free product into subsurface structures
- Begin free product removal as soon as possible
- Submit written report to EPA within 20 days after release confirmation summarizing the initial abatement steps taken

Initial site characterization is required within 45 days and includes information about the site and the nature of the release. Basic characterization data is obtained from existing sources (USGS, previous investigations, etc.).

If free product is encountered, Subpart F requires that a free product removal report be submitted to EPA within 45 days outlining the free product recovery operation.

If there is evidence that the groundwater has been affected, a soil/groundwater investigation must be conducted and EPA may also require a Corrective Action Plan at any step during the Corrective Action process under Subpart F.

OTHER FEDERAL REGULATIONS

The discharge of oil in any quantity to surface waters of the United States is illegal under the Clean Water Act (40 CFR 110).

Since the Chicora's lagoon skimmer is no longer operational and any fuel entering the lagoon is discharged without treatment into the adjacent creek, any discharge of oil to either of the lagoons is classified as an oil spill under 40 CFR 110 and must be reported to the National Response Center. Failure to report the discharge of oil to navigable waters, even a sheen, can result in fines up to \$10,000 and a one year prison term. The courts have interpreted the term "navigable waters" to include all inland waters which drain to navigable waters.

NAVY POLICY

Navy policy is to prevent oil spills and when they do occur, to clean them up as promptly as possible.

OPNAVINST 5090.1, Chapter 13, requires that all oil discharges from Navy Shore Activities be reported immediately by the activity to the National Response Center and Navy On-Scene Coordinator and followed by standard oil spill message format as described in Appendix H of the instruction.

1.4 RECOMMENDATIONS

The following interim recommendations are made to reduce the environmental contamination resulting from the possibility of a continued fuel oil release at Chicora:

1. Report the release to DHEC and the National Response Center.
2. Implement strict safety procedures at the tank farm and upgrade confined space entry procedures until the source of the problem is determined and cleaned up. Conduct daily tests of the fuel vapor level at the tank farm to reduce the risk to employees of inhalation exposure to fuel vapors.
3. Implement strict inventory control methods to detect leaks in tanks and/or piping. Excavate soil cover from a section of at least one tank to provide visual confirmation of the relative leach rate through the tank walls at locations other than the pumprooms.
4. Take prompt action to eliminate the possible release of product from the lagoons. Install a shear gate (or equivalent) on the lagoon outlet. The valve should be closed except during supervised draining of accumulated rainwater. Prior to draining the lagoons, the water surface should be checked for oil. Any oil present, including sheens, should be removed by portable skimmers, vacuum trucks, and/or sorbents. The liner should be repaired to prevent seepage of any fuel spill into the underlying soil.
5. Conduct Phase II Contamination Investigation to determine source and extent of contamination. Design an abatement plan to remediate any environmental contamination discovered.
6. Determine any deleterious chronic effects of the wastewater on the walls of Tank 3906-0. Structural safety of the tank should be the primary objective of the investigation.
7. Install groundwater monitoring wells to detect any leaks from piping and tanks.
8. Include the cost of disposal of oil contaminated soil in all cost estimates for fuel farm projects which require oil excavation.
9. Ensure that all corrective actions and repairs are performed in accordance with all applicable State and Federal regulations.

1.5 PHASE II INVESTIGATION

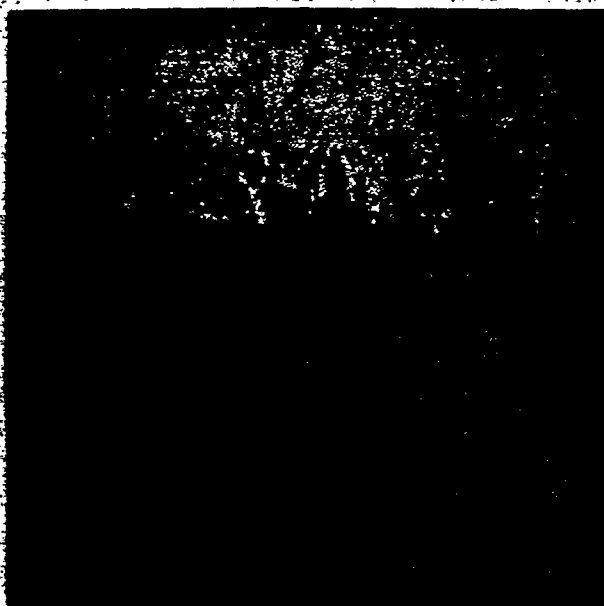
The Phase II investigation will be conducted by SOUTHNAVFACENGCOM by A&E Contract in third quarter FY 89, pending availability of funds. The objective of the investigation will be to determine the location of any tank or pipe leaks, determine the extent of soil and/or groundwater contamination, assess the potential of exposure pathways, and provide cleanup recommendations.

A P P E N D I X I

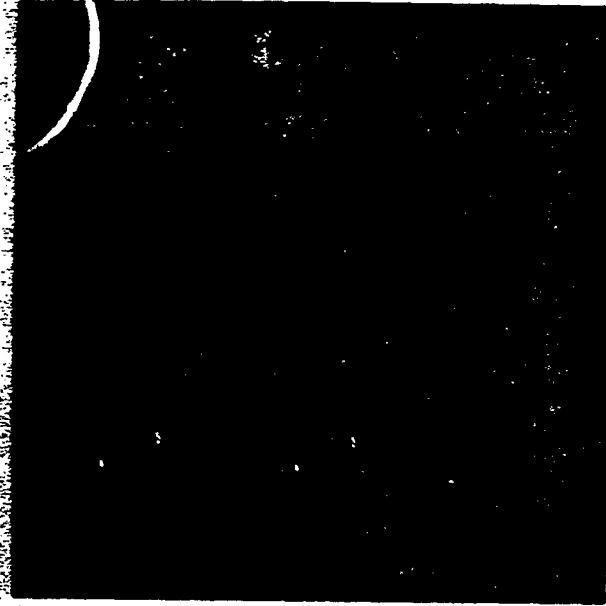
CHICORA TANK FARM PHOTOGRAPHS

Note:

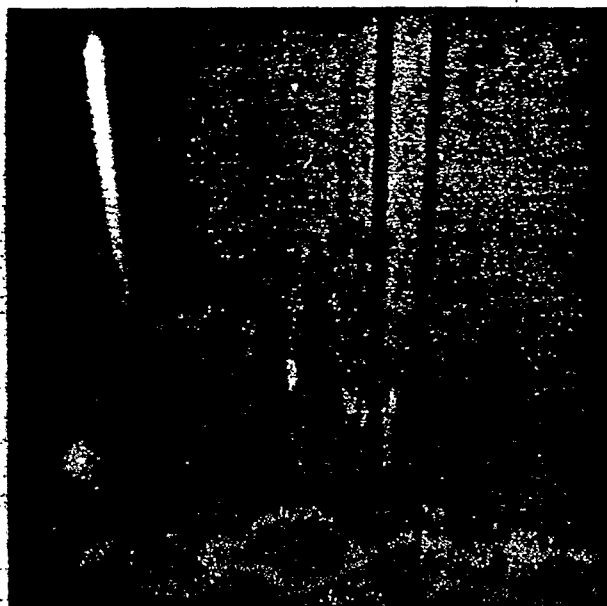
Report copies may not include legibile photographs



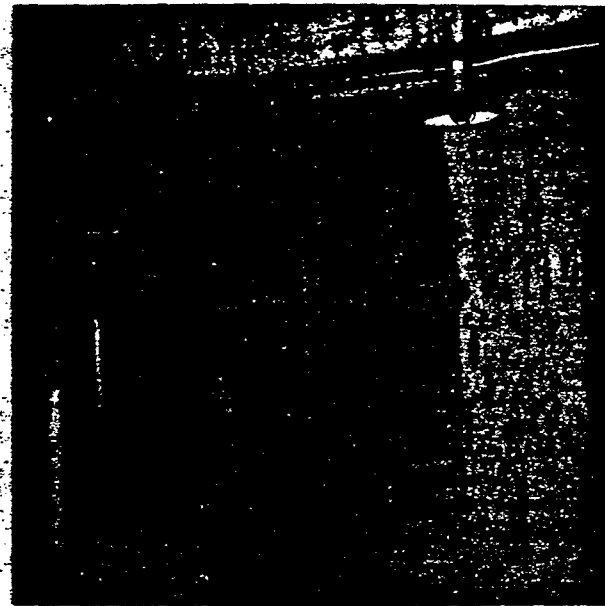
9-28-88 CHICORA TANK FARM - PUMPHOUSE
FOR TANK 3906-K - NOTE CURRENT
DIESEL FUEL LEAKING THROUGH
CONCRETE TANK WALL



9-28-88 CHICORA TANK FARM - PUMPHOUSE
FOR TANK 3906-L - NOTE PREVIOUS
PRODUCT SEEPAGE STAINS ON TANK WALL

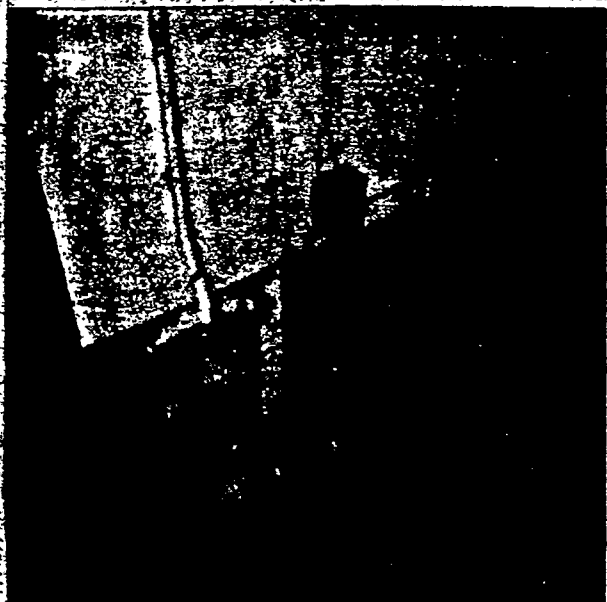


9-28-88 CHICORA TANK FARM - PUMPHOUSE FOR
TANK 3906-M - NOTE SEEPAGE THROUGH
TANK WALL - IT APPEARS AS THOUGH THIS WALL
WAS AT ONE TIME REPAIRED AND PAINTED.

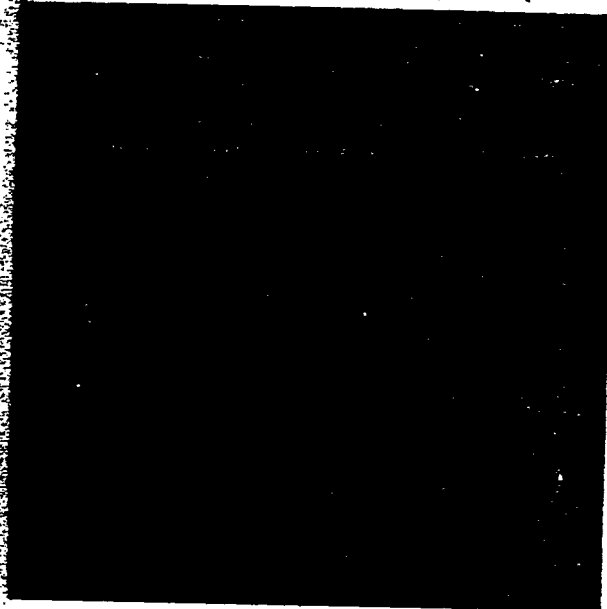


9-28-88 CHICORA TANK FARM -
PUMPHOUSE FOR TANK 3906-P PICTURE IS
OF TANK WALL. PREVIOUS PRODUCT SEEPAGE
IS OBVIOUS.

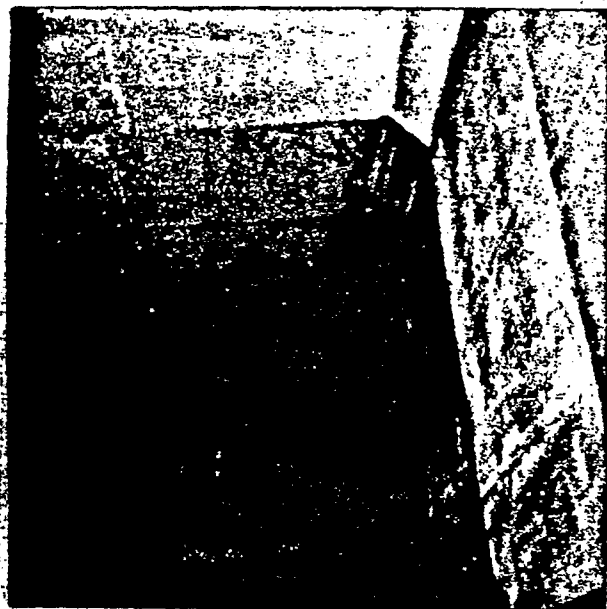
APPENDIX I, PHOTOGRAPHS
CHICORA TANK FARMS



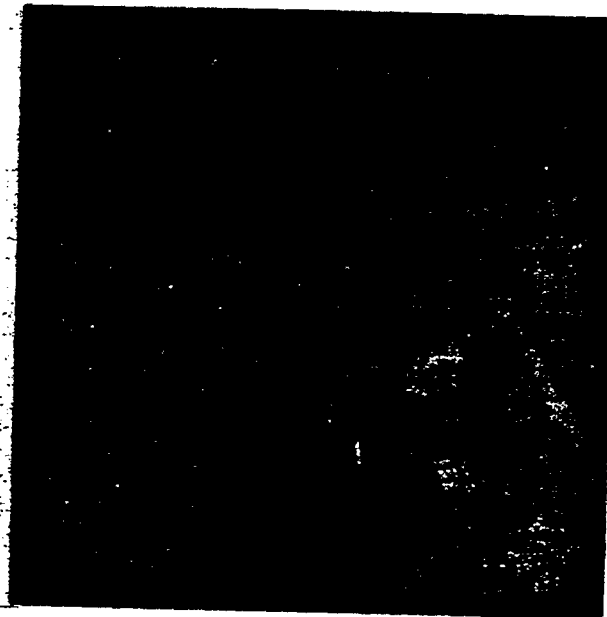
9-28-88 CHICORA TANK FARM - PUMPHOUSE
FOR TANK 3906-D - WATER LINE TO TANK
HAD RECENTLY BROKEN AND FILLED PUMPHOUSE
UP TO DARK LINE - NOTICE PRODUCT ON WALLS AND FLOOR



9-28-88 CHICORA TANK FARM - PUMPHOUSE
FOR TANK 3906-N - LOOKS AS THOUGH TANK
WALL IN PUMPHOUSE HAS BEEN RECENTLY PAINTED
ALSO NOTE WATER ON PUMPHOUSE FLOOR



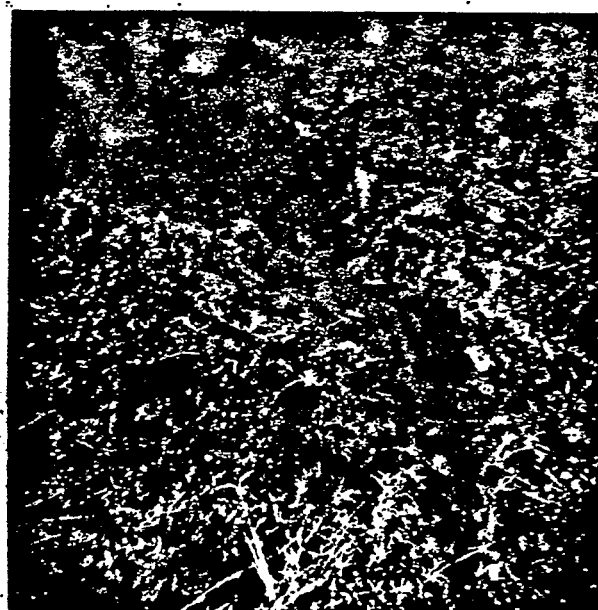
9-28-88 CHICORA TANK FARM -
PUMPHOUSE FOR TANK 3906-D
PRODUCT ON WALLS BECAUSE OF LINE
BREAK



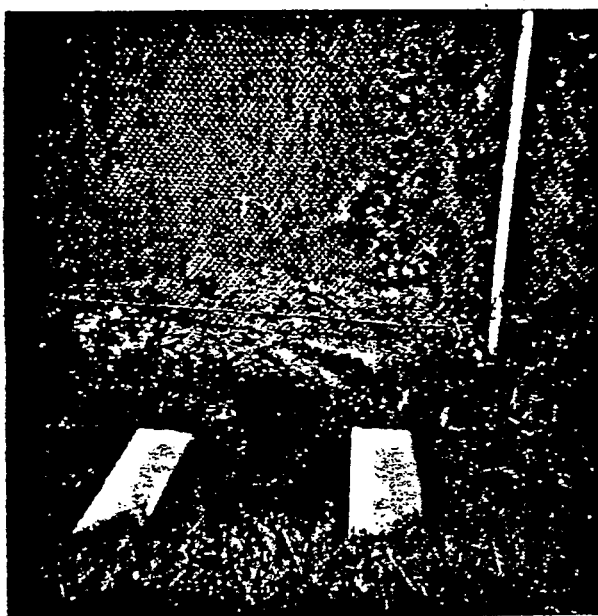
9-28-88 CHICORA TANK FARM
PUMPHOUSE FOR TANK 3906-K
NOTE FRESH PRODUCT ON TANK WALLS
TANK IS BY-FAR THE WORST LEAKING
(TANK CONTAINS DFM)



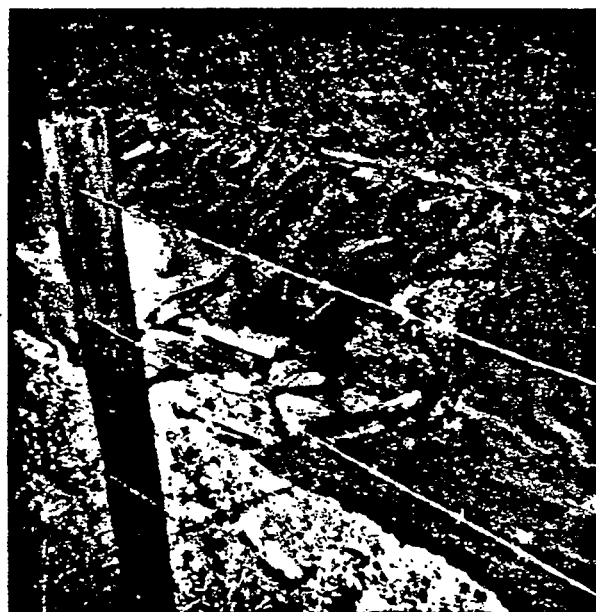
9-19-88 CHICORA TANK FARM - LAGOON
NOTE DEGRADED LINER IN BACKGROUND,
STRESSED VEGETATION, 18" DRAIN PIPE ENTRANCE IN
MIDDLE OF PICTURE



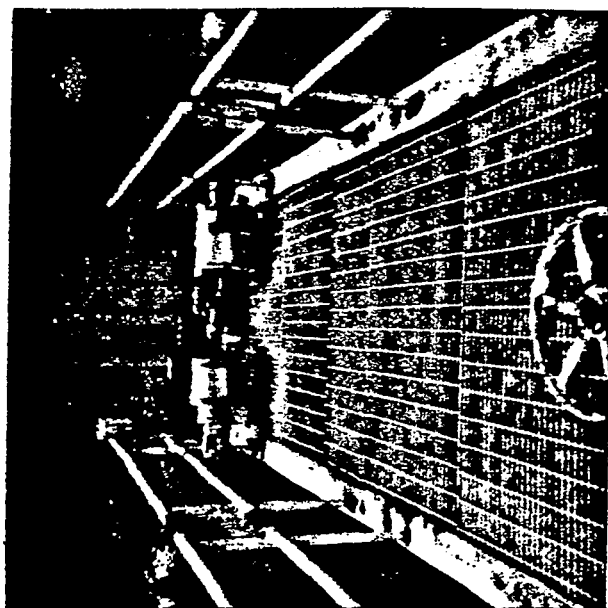
9-19-88 CHICORA TANK FARM - PICTURE OF
STRESSED VEGETATION AND OIL FILM ON SURFACE
OF LAGOON - LAGOON ACCEPTS STREAM FROM
(3) MANHOLES / DRAINAGE SYSTEM



9-19-88 CHICORA TANK FARM - LAGOON
SYSTEM DRAINAGE INTO ADJACENT CREEK.
CREEK GOES TO COOPER RIVER - LAGOONS ARE
FORGET DRAINING



9-19-88 LINED DITCH @ CHICORA
TANK FARM, CHAS. NOTE 36" DRAIN
PIPE BELOW LINER AND WASHOUT AREA



9-19-88 CHICORA TANK FARM - DIKE AND SKIMMER SYSTEM BETWEEN THE TWO LAGOONS. NOTE THE SKIMMER BELTS AND MANUAL WHEEL THAT DIKES FLOW OUT TO THE CREEK.



9-19-88 CHICORA TANK FARM - SHOT OF LAGOON AND SKIMMER SYSTEM. NOTE WASTE OIL HOLDING TANK TO THE LEFT.



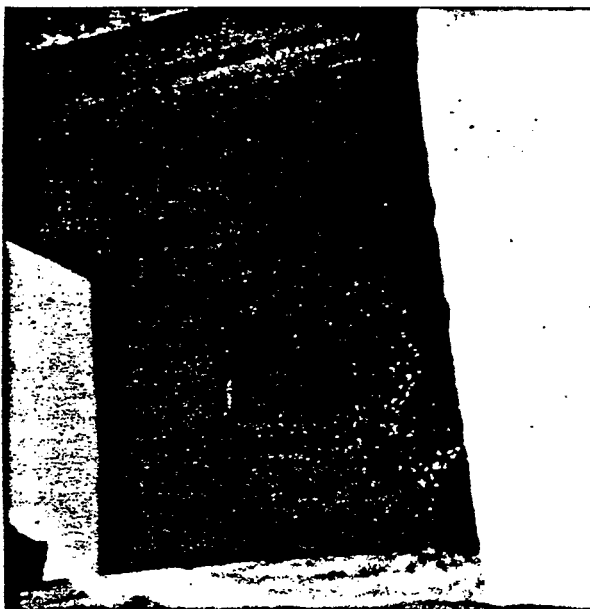
9-19-88 CHICORA TANK FARM - LAGOON ACCEPTING STREAM FROM LINED DITCH IN UPPER LEFT CORNER OF PICTURE - NOTE BUBBLES UP 30 MIL LINER IN MIDDLE OF LAGOON.



9-28-88 CHICORA TANK FARM - CONTAINMENT LINER ON N.E. PORTION OF PROPERTY - NOTE DEGRADED LINER AND SEVERE EROSION.



8-98 CHICORA TANK FARM - MANHOLE "A"
WITH PIPE RUNNING FROM TANK 3906-K
NOTE "X" 2" PRODUCT ON MORTAR SURFACE
PICTURE TAKEN IN 8/88



9-19-88 CHICORA TANK FARM - PICTURE OF
MANHOLE "B" COMING FROM TANK 3906-P
NOTE PRODUCT ON WATER'S SURFACE

APPENDIX I, PHOTOGRAPHS
CHICORA TANK FARM